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METHODS OF DISTINGUISHING TYPES OF SOY BEAN VIRUSES

[Following is a translation of an article by Iida Kaku, Director, Insect and Blight Laboratory, First Cultivation Division, Tohoku Agricultural Experimental Station, Ministry of Agriculture and Forestry, in a Japanese-language publication [source unknown], pp 35-37.]

At present, soy bean mosaic disease, soy bean dwarfing disease, mosaic disease due to alfalfa mosaic virus, mosaic disease due to kidney bean yellow spot mosaic virus, and the bud blight disease due to tobacco ring spot virus are known as soy bean viruses. Of these, in Japan the two types, soy bean mosaic disease and soy bean dwarfing disease, are most widely spread and they cause the greatest damage. The mosaic disease due to the alfalfa mosaic disease, and the mosaic disease due to kidney bean yellow spot mosaic virus have less occurrences as compared with the former two types, and show less damage, too. The bud blight disease due to tobacco ring spot virus causes the least damage among soy bean viruses. Fortunately so far its occurrence has not been detected in Japan.

Methods of Distinguishing Virus Diseases

The types of soy bean viruses are distinguished by differences in infection methods, differences in symptoms, differences in the physical characteristics of the viruses, and differences in the pathogenity and symptoms by the detection of plants and detection of species, examination through serological methods, and differences in the shapes and sizes of virus particles through electron microscope.

Symptoms

(1) Soy Bean Virus: In the seed infected stalk, the leaf vein becomes transparent, and gradually manifests thick

and thin mosaic symptoms. In the mature plant, the leaf vein at first becomes transparent, and afterward this is turned into thick and thin mosaic symptoms, and they swell like water bubbles along the leaf vein. Sometimes the leaf curls and becomes like a bamboo leaf.

In some viruses, many species of soy bean manifest such symptoms as dwarfing, leaf curling and rolling, and bud blight.

(2) Soy bean Dwarfing Disease: In the seed infected stalk, sometimes thick and thin spots appear on the surface of the seed leaf immediately after budding, but in many cases, small delicate spots appear beginning at the time of the development of the first leaf. In the diseased plant, leaves are smaller and the plant height is shorter, but leaf curling and rolling as in mosaic disease, does not occur. In some species of soy bean almost no symptoms appear, which makes detection very difficult.

(3) Mosaic Disease due to Alfalfa Mosaic Virus: Different symptoms appear depending on different viruses and species of soy bean. However, generally such symptoms as transparent leaf virus and yellow-orange spots appear. The leaf hardly shows any deformation, but the plant as a whole shows dwarfing. In some species, necrosis in the tip occurs.

(4) Mosaic Disease due to Kidney Bean Yellow Spot Mosaic Virus: In this case, a part of the leaf vein becomes transparent, or small delicate yellow-green spots appear. Although the transparent leaf vein or yellow-green spots remain a long time, the shape of the leaf is hardly changed.

(5) Bud Blight Disease due to Tobacco Ring Spot Virus: In the case of the seed infected stalk, the first grown leaf shows transparent leaf veins or delicate frost-like mosaic symptoms; its growth is markedly retarded and the plant height is short. In the infected stalk, the bud turns brown, and it shows much bending, and finally wilts.

Infection Methods

Soy bean mosaic disease, soy bean dwarfing disease, and the bud blight disease due to tobacco ring spot virus are all seed infected, but in other types of soy bean viruses no seed infection occurs. With the exception of the bud blight disease due to tobacco ring spot virus, all other types of soy bean viruses are infected through cockroaches.

Brown Spot Grains

In soy bean stalks infected with soy bean mosaic disease and soy bean dwarfing disease, spotted seeds, the so-called brown spot grains, grow. In the brown spot seed of the soy bean plant infected with soy bean mosaic disease, spots grow perpendicularly to the navel of the grain. In the brown spot seed of the soy bean plant infected with soy bean dwarfing disease, ring spots grow. Accordingly, by the types of spots, the types of virus can be distinguished. In soy bean stalks infected with both viruses, the entire surface of some seeds is colored. The color of brown spots is the same color as the navel.

Distinguishing Methods by the Use of Detection Plants

As shown in Table 1, types of soy bean viruses can be distinguished by the use of species of soy beans (Enshiken, Norin Number Two, Tokachi Nagaba), kidney beans, cowpeas, sweet peas, ebisugusa [translated from Japanese], and tobacco, and the symptoms appearing on them.

Table 1
Reactions of the Pathogenic Virus of Soy Bean Viruses
in Plants and Species Detection

① ウイルスの種類 ⑨ ウイルスの系統	② タイズヒロイ クウイウス				③ タイズヒロイ クウイウス			④ アルファ ウイルス			⑤ キンゲン ウイルス			⑥ トバコ ウイルス		
	A	B	C	D	A	B	C	A	B	C	A	B	C	A	B	C
⑩ 大 豆	O	S	S	S	O	S	S	S	O	O	O	O	O	S	S	S
⑪ 豆 子 (豆 子 2 号)	O	S	S	S	O	S	S	S	O	O	O	O	O	S	S	S
⑫ トウモロコシ	S	S	O	O	S	S	O	S	S	S	S	S	S	S	S	S
⑬ インゲン (豆 子 3 号)	S	S	O	O	S	S	O	S	S	S	S	S	S	S	S	S
⑭ サルゲ (豆 子 3 号)	O	O	L	S	S	L	L	L	O	O	S	S	S	S	S	S
⑮ スイートピー	O	O	L	L	S	S	S	S	S	S	S	S	S	S	S	S
⑯ エビスグサ	L	L	O	O	L	L	L	L	L	L	L	L	L	O	O	O
⑰ タバコ	O	O	O	O	S	S	S	S	O	O	O	O	O	S	S	S

L: local infection; S: Entire infection; O: No infection.

[Legend]: 1) Types of virus; 2) Soy bean mosaic virus; 3) Soy bean dwarfing virus; 4) alfalfa virus; 5) mosaic; 6) kidney yellow mosaic; 7) bean spot virus; 8) Tobacco ring mosaic virus; 9) virus strains; 10) Enshiken; 11) soy bean Norin No. 2; 12) Tokachi Nagaba; 13) kidney bean (Vineless Kintoki); 14) Cowpea (Black seed 3 ft); 15) Sweet Pea; 16) Ebisugusa; 17) Tobacco.

The Characteristics of Pathogenic Virus

Table 2 shows the characteristics, shapes and infection methods of pathogenic viruses. As shown in Table 2, it can be seen that the shapes of viruses differ according to their types.

Table 2

Various Characteristics of Viruses

		①	②	③	④	⑤	⑥	⑦	⑧
		大豆花紋ウイルス	大豆矮化ウイルス	アルファモザイクウイルス	タバコモザイクウイルス	豆斑ウイルス	タバコ花紋ウイルス	タバコ花紋ウイルス	タバコ花紋ウイルス
⑨	感染方法	+	+	+	+	+	+	+	+
⑩	形状	+	+	+	+	+	+	+	+
⑪	感染方法	+	+	+	+	+	+	+	+
⑫	感染方法	+	+	+	+	+	+	+	+
⑬	感染方法	+	+	+	+	+	+	+	+
⑭	感染方法	+	+	+	+	+	+	+	+
⑮	感染方法	+	+	+	+	+	+	+	+
⑯	感染方法	+	+	+	+	+	+	+	+
⑰	感染方法	+	+	+	+	+	+	+	+
⑱	感染方法	+	+	+	+	+	+	+	+
⑲	感染方法	+	+	+	+	+	+	+	+
⑳	感染方法	+	+	+	+	+	+	+	+

[Legend]: 1) Soy bean mosaic virus; 2) soy bean dwarfing virus; 3) alfalfa mosaic virus; 4) kidney yellow mosaic; 5) bean spot virus; 6) tobacco mosaic; 7) ring virus; 8) brown spot grain; 9) radial; 10) ring spot; 11) Infection Method sap; 12) cockroach; 13) Seed; 14) physical; 15) characteristics; 16) heat endurance; 17) dilution endurance; 18) pre-preservation endurance; 19) Form of virus; 20) days; 21) string; 22) globe.

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